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Research Note

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TIME REQUIRED TO PRUNE CROP TREES IN THE WESTERN WHITE PINE TYPE

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Pruning time studies conducted on the Deception Creek Experimental Forest near Coeur d'Alene, Idaho disclose the average man-day production in two white pine stands and one mixed stand dominated by grand fir. The average production ranged from 37 trees per man-day in a fairly open white pine stand to 16 trees per man-day in a dense, brushy, mixed stand.

THE STUDY

Pruning time data were collected on three projects using 4- to 6-man crews composed of high school seniors and college freshmen. The production figures include all administrative time for supervision and marking as well as total crew time involving travel between trees, rest periods, and other delays. The number of trees pruned was tallied by pruned-height for each crewman for each 8-hour working day.

Trees were pruned with saws recommended by Davis in an earlier test of pruning equipment. 1/ Two types of saws were used, pistol grip hand-pruning saws with 12-inch curved blades containing 8 saw points per inch cutting on the draw stroke, and pole-pruning saws with 18-inch slightly curved blades containing 5 saw points per inch also cutting on the draw stroke. Two pole saws were used, one with an 8-foot and one with a 14-foot handle.

1/ Davis, Kenneth P. Test of pruning equipment and methods in western white pine. Northern Rocky Mountain Forest and Range Experiment Station. Applied Forestry Notes No. 76, 1936. 9 pp. illus.

The crew foreman selected approximately 200 of the best trees per acre to be pruned.2/ The crew pruned the trees in three operations. In the 4-man crew organization, two men equipped with hand saws pruned as high as they could reach. A third man continued the pruning with an 8-foot pole saw. A fourth man completed the job with a 14-foot pole saw when the tree was tall enough to permit pruning to a full log length, or about 18 feet.

Upper Sands Creek

The first study was made in the upper Sands Creek unit of the Experimental Forest. A 30-year-old stand of natural reproduction had been weeded in 1935, leaving a fairly open stand dominated by western white pine. Approximately 200 of the best pines per acre were pruned. Pruned trees averaged 5.5 inches in diameter. About one-tenth of the pruned trees were tall enough to permit pruning a full log length without removing more than 40 percent of the live crown. The remaining trees will be pruned to a full log length in about 5 years. Following are the number of trees pruned, lengths of stem pruned, and the effort expended per tree for each operation:

Operation	Trees pruned per average man-day	Average length pruned	Average pruning time per tree
	Number	Feet	Man-days
With hand saw	136	9.17	0.0074
With 8-foot pole saw	184	5.22	.0054
With 14-foot pole saw	70	5.69	.0143
Total		20.08	.0271

At this rate, 37 trees were pruned to a full log length per man-day. This figure probably could be increased somewhat if pruning were carried to 18 feet rather than the 20 feet averaged in this project.

White pine plantation

The second stand pruned was a 17-year-old white pine plantation in the Sands Creek unit. The trees were planted with a spacing of 7x7 feet, and the crowns were just beginning to close at the time of pruning. Average tree diameter was not measured, but it was about 4.5 inches. The average branch diameter appeared to be somewhat larger than in the natural stand because of the wider spacing between trees.

2/ Pruning should be restricted to crop trees, which would usually range from 100 to 200 per acre in the western white pine type.

Only hand saws were used in pruning the plantation. The trees were pruned to an average height from the ground of 8.5 feet at a labor cost of 0.0097 man-day per tree. The crew with the hand saws pruned 103 trees per man-day compared to 136 trees per day in the natural stand. The difference in production probably can be explained by the difference in average branch diameter and by a difference in crews. The crew that pruned the natural stand was more experienced.

Upper Deception Creek

The third pruning was made in a 50-year-old natural stand of mixed species dominated by grand fir. The stand is located on a steep south-facing slope with a dense stand of brush, mostly ninebark, mountain maple, and bitter cherry. In addition to the brush cover, the stand of trees was also very dense. The density of the stand and the steepness of the slope made it difficult to maneuver the pole saws.

The 200 best trees per acre were selected for pruning irrespective of species. Seventy percent of the trees pruned were grand fir, 20 per cent were Douglas-fir, and 10 percent were white pine. Pruned trees averaged 6.2 inches in diameter. Following are the number of trees pruned, lengths of stem pruned, and the average labor per tree for each operation:

Operation	Trees pruned per average man-day	Average length pruned	Average pruning time per tree
	Number	Feet	Man-days
With hand saw	122	9.04	0.0082
With 8-foot pole saw	85	5.33	.0118
With 14-foot pole saw	23	5.19	.0435
Total		19.56	.0635

At this rate only 16 trees were pruned to a full log length per man-day. Again, this figure could be increased if pruning were carried to 18 feet rather than to the height averaged in this study.

The hand saw production in this older stand with somewhat larger stems compared favorably with that in the other two stands, 122 trees pruned to an average height of 9 feet. The large reduction in total production was a result of more difficult pole-saw pruning. For example, the men with the 14-foot pole saws completed only 23 trees per day on Deception Creek compared with 70 trees per day in the Sands Creek unit. As the same crew pruned both of these areas, the difference was due to something other than crew efficiency.

On-the-job observations indicated that stand density was the major cause of lower pole-saw production in the mixed stand. Difficulty in maneuvering the poles increased the time required to get in position to saw each branch as well as the time between trees. More difficult sawing and terrain also made the workers tire quickly, necessitating frequent rotation of jobs among the crew.

Tree species also affected pruning time. A small-scale study was made in the Upper Deception Creek stand to measure the effect of species. Ten pairs of trees, consisting of a white pine and a grand fir similar in tree size and condition of branches, were selected. The time required to prune each tree to a height of 7 feet was measured with a stop watch. The average time for pruning the pines was 75 percent of that required for the grand firs. The time difference was less for the lower portion of the stem where most of the branches were dead.

DISCUSSION

An earlier report on the increased value of pruned logs at harvest presents data to show that pruning western white pine is a profitable forest practice.3/ That report states, "For example, table 2 shows that a pruned butt log of white pine, having a 4-inch knotty core and harvested at 21 inches d.b.h., will yield $48.56 more per thousand after pruning costs than an identical unpruned log."

Pruning time is important because it is the largest item contributing to the initial pruning investment. Observations and records from this study show that the following factors influence labor time:

Density of stocking and brush cover.
Number, size, and condition (live or dead) of branches.
Topography.
Height of pruning.
Tree species.
Crew training, experience, and supervision.

This test was designed to provide estimates of the time required to prune white pine crop trees to a height of 18 feet. Data from it show that with average stand conditions approximately 37 trees can be pruned per man-day. The data also show that a combination of the factors listed above can reduce the man-day production to as low as 16 trees. Although there was no accurate measurement of the extent to which each factor influences labor time, consideration of them will help determine whether the cost of pruning a particular stand will be more or less than average. The results of this study can serve as a general guide in estimating pruning costs.

3/ Huey, Ben H. The profit in pruning western white and ponderosa pine. Northern Rocky Mountain Forest and Range Experiment Station. Research Note No. 85, 1950. 6 pp. illus.